

We Have All Been Here Before

Recurring Patterns Across 12 U.S. Air Force Acquisition Programs

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Introduction

Agenda

Introduction

- Independent Technical Assessments (ITAs)
- Approach

Findings

- Categorized Findings
- IT System Findings
- Continuing/Emerging Trends

Analysis

- Candidate Root Causes
- Mitigating Root Causes
- Overarching Themes
- Misaligned Incentives



Introduction

SEI ITA Background

SEI conducts Independent Technical Assessments (ITAs) on large software-reliant acquisition programs

- ITAs are objective program reviews of people, programmatics, processes, technical aspects, and the environment
- ITA teams conduct interviews & review documents on program status/history
- Identify likely causes of schedule, cost, or performance issues
- Recommend improvement or recovery actions

SEI brings to the assessments

- Software, systems engineering and program management expertise
- Independent and neutral third-party assessment
- Experience in conducting over 100 ITAs and Red Teams



Introduction

ITA Pattern Analysis Objectives

Identify recurring patterns, both positive and negative, that the SEI has observed across this set of ITAs:

- Strengths
- Best practices
- Weaknesses
- Issues

Provide practical information on acquisition:

- Identify underlying causes recurring problems
- Make actionable recommendations to address current, and to prevent future problems



Introduction

Approach

Gather data from 12 Air Force programs reviewed between 2006 and 2009:

- 6 IT system programs
- 2 Command and Control (C²) programs
- 2 communications system programs
- 1 avionics system program
- 1 electronic warfare system program

Perform qualitative analysis of findings

- Divide out information by system type in relevant areas (i.e., IT systems)
- Consider relevant information from other acquisition programs

Identify higher-level relationships across the findings

Identify potential root causes of cost, schedule, scope, and quality issues

Recommend corrective/preventative strategies based on these patterns



Introduction

Limitations

ITA data is inherently *qualitative*

- Sample set of 12 programs is small
- Some ITAs were focused on one aspect, such as testing
- Data was not collected with intention that it be used quantitatively
- Data is biased by different ITA team expertise areas
- Programs were selected because they were already in trouble

The most frequent findings may not be the most important ones

Fundamental root causes may not be explored by ITAs

- Root causes not always needed to make practical recommendations
- ITA work is focused on helping the program—not doing research
- Example: Untrue that “Poor estimate” means “Can’t do good estimates”

Best practices may not always be found by ITAs

- Focus is primarily on identifying issues to be remedied



Findings

Most Common Findings

Staffing	Inadequate PMO staff expertise	9 occurrences
	Hostility between stakeholders	8 occurrences
	Poor contractor oversight by PMO (<i>too reliant on contractor</i>)	
	Insufficient PMO staff	6 occurrences
	Poor user/stakeholder involvement	
Requirements	High PMO staff turnover	
	Ineffective risk management	
	Overly optimistic schedule	
	Poor contractor oversight by PMO (<i>insufficient metrics</i>)	5 occurrences
	Requirements scope creep	
	Inadequate requirements	
	Unpredictable delivery dates	
	"Big Bang" integration	
	Immature technology	
	Lack of functional requirements baseline	4 occurrences
	Lack of Integrated Master Schedule (IMS)	
	Poor process adherence	
	Unanticipated technical complexity	



Findings

Top 10 Overall Categories for Findings

Category	Percent	Aspects
Staffing	20%	Expertise, turnover, staff size
Requirements	10%	Adequacy, clarity, creep, baseline
Oversight	8%	Adequacy, metrics
Schedule	8%	Master schedule, predictability
Testing	7%	Fidelity, adequacy, hardware, data
Technical	6%	Complexity, maturity
Culture	6%	Inter-team relationships
Organizational	5%	Management, formality, dispersion
Stakeholder Involvement	4%	Level of involvement with program
Risk Management	3%	Effectiveness



Findings

Key IT System Findings

Ineffective User/Stakeholder Involvement

- Stakeholders not adequately involved in requirements or testing

Poorly Executed Change Management

- Little account for system impact on existing business processes
- Often resulted in (avoidable) user resistance to the new system

Lack of Program Management Rigor

- Business (vs. acquisition or IT) people were running the program
- Requests for new requirements not constrained—drove cost/schedule
- Inappropriate contractual vehicles

Technical Complexity is Rarely an Issue

- Technical complexity was not a significant issue for most IT systems



Findings

Continuing and Emerging Trends

Contracted PMO Staff

- This ongoing trend will be reversed by plans to bolster the acquisition workforce

Interoperability and Open Systems

- Leveraging of system capabilities through interoperability is expected to grow, building on modular design and open standards, moving toward SOA

Joint/Common Programs

- More expected to help reduce costs, despite real management challenges

Geographically Distributed Teams

- Continuing growth of dispersed teams is increasing risk of poor performance

Internet/Web Applications

- Need for Web access to key IT systems is forcing legacy modernization efforts

Enterprise Resource Planning (ERP)

- Increasing ERP use for IT systems driving business process changes

Agile Development

- Some interest in integrating agile methods with DoD 5000.02



Analysis

Possible Relationships Among Findings

Program Management by “Functionals”

- leads to low PMO staff experience, which...
- leads to overreliance on contractor, which...
- leads to poor contractor oversight, which...
- leads to unpredictable delivery dates

Geographically Separated Sites

- lead to poor communication/cooperation, which...
- leads to conflict across sites

Inadequate PMO Staff Experience

- leads to poor stakeholder involvement, which...
- leads to inadequate requirements, which...
- leads to unplanned rework, which...
- leads to schedule slip

Need to ‘Sell’ the Program

- leads to overly optimistic schedule, which...
- leads to schedule pressure, which...
- leads to contractor sacrificing quality processes, which...
- leads to unplanned rework, which...
- leads to schedule slip



Analysis

Candidate Root Causes -1

Geographically Separated Sites

- Separated sites have extra coordination overhead and poor visibility, causing delays and frustration that may turn into mutual suspicion and growing conflict

Use of Advanced/Immature Technology

- Users, government, and contractors all prefer highly advanced technology—but its inherent immaturity drives up risk and cost, and lengthens schedule

Diminished Acquisition Workforce

- Inexperienced PMO staff are less able to properly select and oversee technical contractors, and thus less able to ensure successful outcomes

Ambitious Requirements

- The desires for higher capability and “compelling” programs drive ambitious, unprecedented requirements that increase complexity and risk

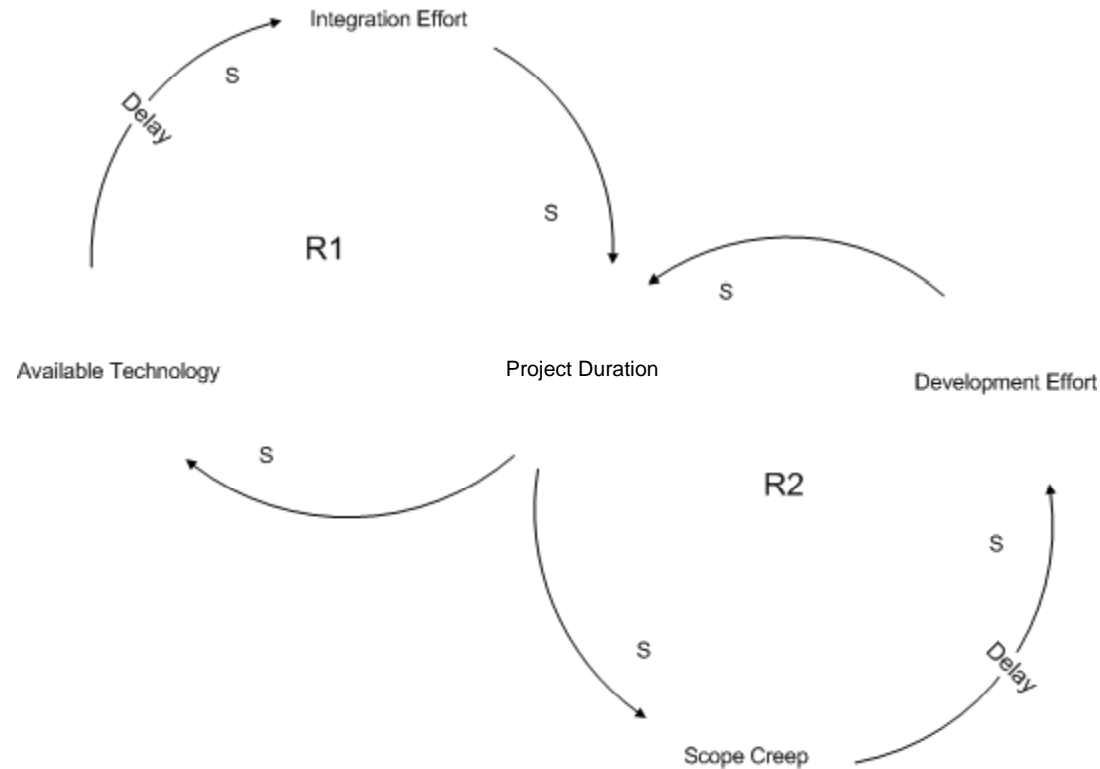
Long Program Duration

- Large programs have long schedules—during which environment changes drive scope changes, causing even longer schedules and higher cost



Acquisition Dynamics Analysis

Long Program Duration - “Longer Begets Bigger”



Analysis

Candidate Root Causes -2

Instability of Program Funding

- Political concerns produce funding volatility that consumes effort in replanning, requiring programs to extend schedule or reduce scope

Military Rotations

- Short-term PM rotations place emphasis on near-term program health, creating incentives to put off longer-term investments that have no immediate benefits

Underestimation

- Both the PMO and contractor have incentives to underestimate cost to ensure that a program is funded—or else they're both out of a job

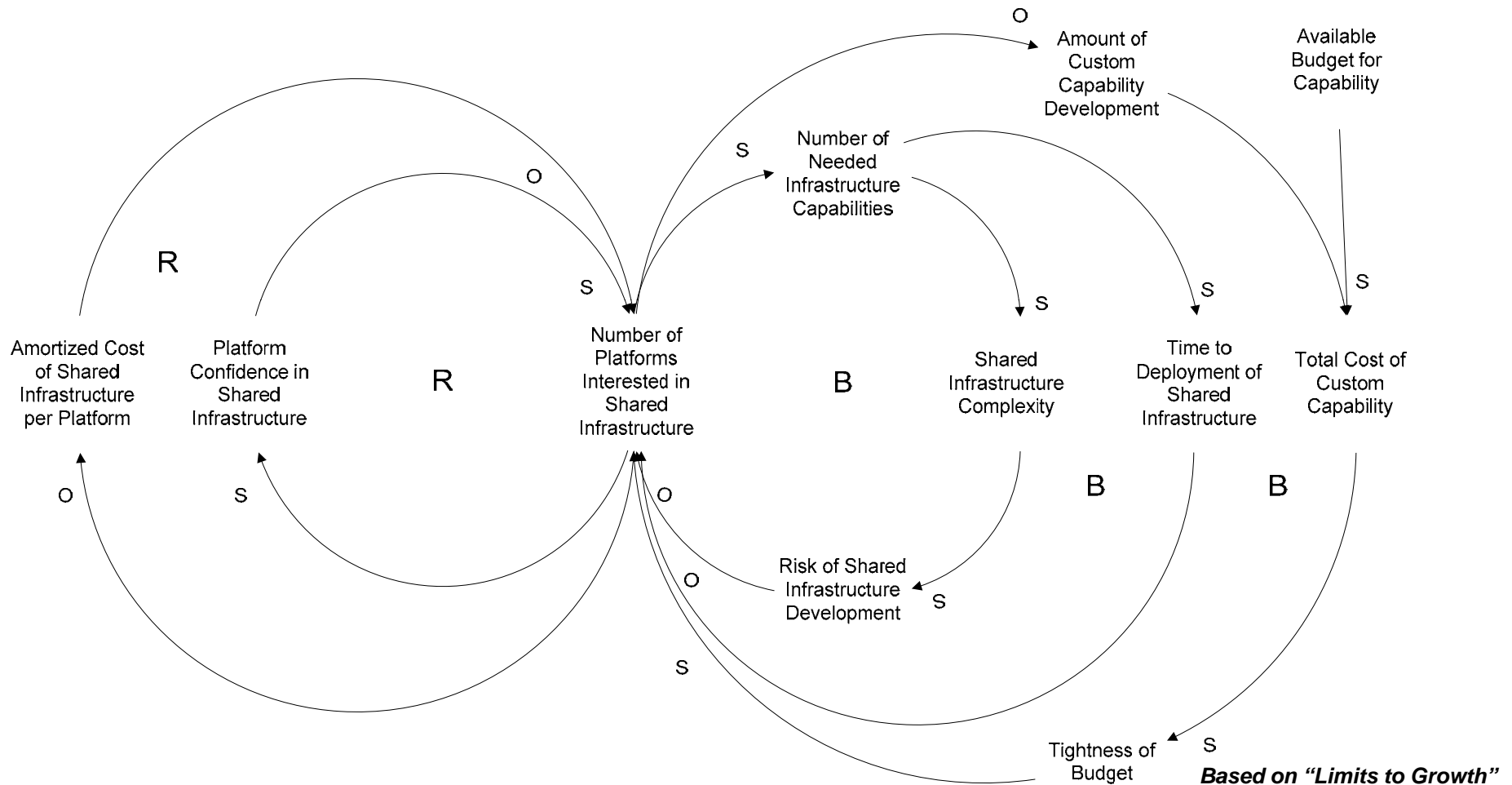
Joint Programs/Common Infrastructure

- Common infrastructure programs must reconcile competing needs into one system—but this drives up cost and schedule, and drives user programs away



Acquisition Dynamics Analysis

Joint Programs – “Everything for Everybody”



Analysis

Mitigating Root Causes -1

Geographically Separated Sites

- Favor the use of co-located developers whenever possible
- Substantially invest in regular on-site presence at other sites through travel with face-to-face contact with other sites.

Use of Advanced/Immature Technology

- Increase use of Technology Readiness Assessments (TRAs) to improve visibility of the technology maturity
- Independently review PMO choices of technologies to be assessed

Diminished Acquisition Workforce

- Improve qualifications of acquisition staff emphasizing software expertise, and improve compensation and advancement opportunities to increase tenure.

Long Program Duration

- Divide large acquisition development efforts into multiple smaller, shorter duration programs.

Instability of Program Funding

- Buffer programs from funding variations to improve stability and productivity. ●



Analysis

Mitigating Root Causes -2

Military Rotations

- Assign PMs, DPMs, and other key positions for the program's duration and into deployment. Use civilians if military rotations are not amenable.

Underestimation

- Don't require PMO to adopt contractor's estimate for the program—or else use the difference as PM “reserve”
- Change from traditional 50% estimation confidence level to 80% level
- DoD should consider use of Vickrey “second price” auction mechanism for acquisition proposal bidding

Joint Programs

- Consider oversight above Senior Acquisition Executive (SAE) level to help ensure cooperation among multi-Service stakeholders.



Analysis

Overarching Themes

It's the People, Not the Software

- Software engineering issues are rarely the main reason programs fail
- Technical issues accounted for only 6% of the ITA findings

The Need to Sell the Program

- Acquisition promotes 'selling' programs with 'unfounded optimism and parochialism'

The Evolution of "Science Projects"

- Prototypes that grow in scope during development often fail the transition to become production-quality systems

Common/Joint Programs Replace "Islands of Automation"

- The temptation of an ideal custom solution vs. a shared "one-size-fits-all" system is often too great for stakeholders to resist

Misaligned Incentives

- People are too often incented to do what's best for themselves, at the expense of their organization or larger community



Analysis

Misaligned Incentives

The acquisition system incentivizes...

- PMOs to 'sell' programs, even when making poor progress
- PMOs to downplay risks, even if they may jeopardize the program
- PMOs to do "big bang" integration to shorten schedule, despite the risk
- PMOs to choose the low bidder, even if it may cause poor performance/quality
- Contractors to underbid programs, and then overrun cost/schedule
- Contractors and PMOs to use immature technology, driving up cost/schedule
- Contractors to move expert staff off awarded programs, onto proposed programs
- Services and contractors to prefer siloed systems over Joint programs
- Military personnel to leave programs soon after they become valuable staff
- Cost-Plus contracts that inadvertently encourage longer programs
- DoD to fund too many programs, thus underfunding all of them
- Users to demand exotic features, because they bear no cost for doing so

...and these behaviors indirectly drive many key reasons for failure



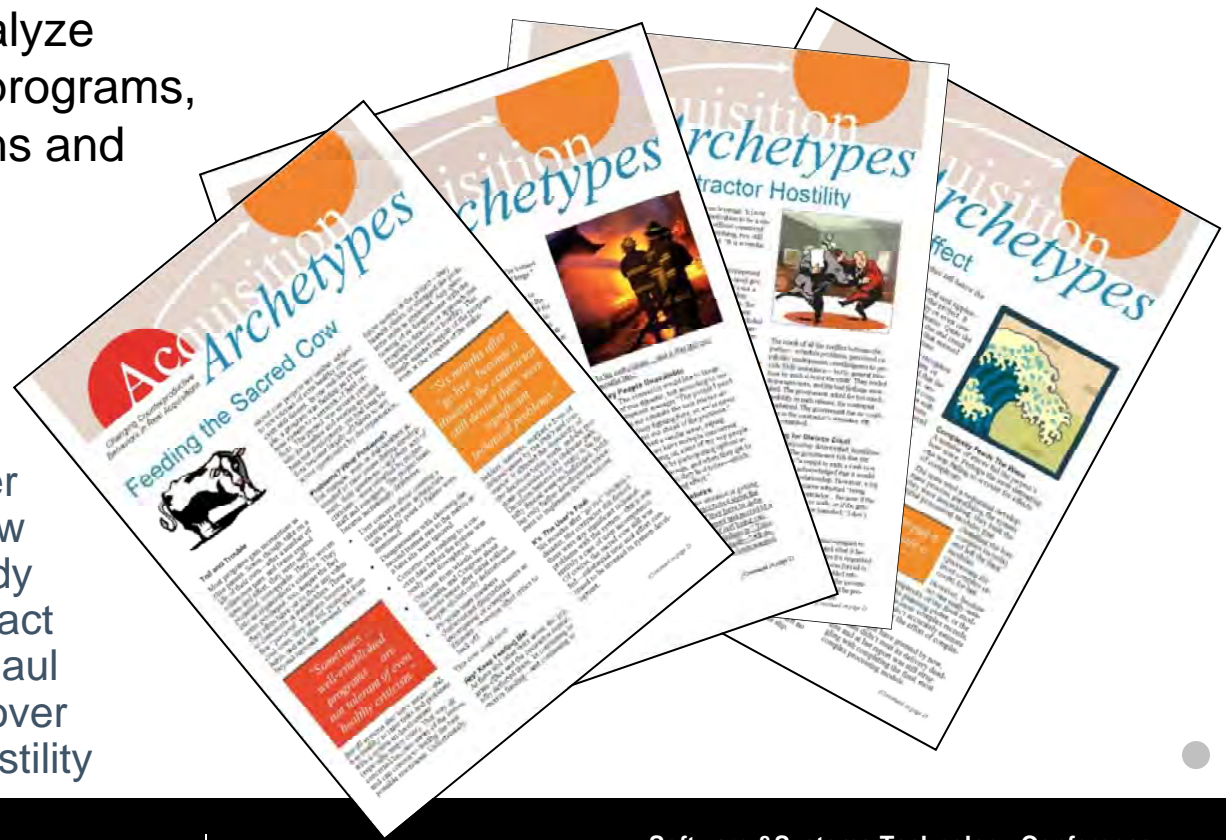
Acquisition Analysis at the SEI For Additional Information

Upcoming SEI Technical Note: *"An Analysis of Recurring Issues Found Across 12 U.S. Air Force Software-Reliant Acquisition Programs"*

Website: <http://www.sei.cmu.edu/acquisition/research/archetypes.cfm>

"Acquisition Archetypes" analyze recurring patterns in actual programs, and recommend interventions and preventative actions:

- Firefighting
- Brooks' Law
- "Happy Path" Testing
- Longer Begets Bigger
- The Bow Wave Effect
- Shooting the Messenger
- Feeding the Sacred Cow
- Everything for Everybody
- Underbidding the Contract
- Robbing Peter to Pay Paul
- Staff Burnout and Turnover
- PMO vs. Contractor Hostility





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